Available online at www.sciencedirect.com
SciVerse ScienceDirect
Comprehensive Psychiatry 53 (2012) 63–70
Comprehensive PSYCHIATRY
www.elsevier.com/locate/comppsych

Sociodemographic and psychiatric determinants of attrition in the Netherlands Study of Depression and Anxiety (NESDA)

Femke Lamers[a,*], Adriaan W. Hoogendoorn[a], Johannes H. Smit[a], Richard van Dyck[a], Frans G. Zitman[b], Willem A. Nolen[c], Brenda W. Penninx[a,b,c]

[a]*Department of Psychiatry and the EMGO Institute for Health and Care Research, VU University Medical Center Amsterdam, The Netherlands*
[b]*Department of Psychiatry, Leiden University Medical Center, The Netherlands*
[c]*Department of Psychiatry, University Medical Center Groningen, University of Groningen, The Netherlands*

Abstract

Background: Although attrition is inevitable in longitudinal epidemiological studies, psychiatric studies are thought to be especially sensitive to attrition. This study aimed to evaluate the sociodemographic and psychiatric determinants of attrition at 2-year follow-up in the Netherlands Study of Depression and Anxiety.
Methods: Logistic regression was used to examine sociodemographic and psychiatric determinants of attrition and the influence of clinical psychiatric characteristics on attrition. In addition, differences in determinants between 3 types of attrition (refusal, noncontact, and not able to participate) were evaluated.
Results: The attrition rate at the 2-year follow-up assessment was 12.9% (385/2981), representing 6 deceased persons, 250 refusers, 51 noncontacts, and 78 persons unable to participate because of health reasons. Determinants of attrition were younger age, less years of education, not being of North European descent, being recruited in Amsterdam, no previous participation in research, and having major depressive disorder. Only the effects of age, sampling site, and previous participation in research differed between types of attrition. Furthermore, comorbid depressive and anxiety disorders and higher symptom severity were associated with attrition.
Conclusions: In contrast to the view that psychiatric epidemiological research is more prone to high attrition rates, this study revealed a relatively low attrition rate. Furthermore, both sociodemographic and psychiatric variables were independent determinants of attrition. Oversampling of subgroups that are at higher risk of dropout may be advisable for future psychiatric cohort studies.

1. Introduction

Attrition is a problem faced by all longitudinal epidemiological studies, resulting in loss of power and potentially introducing bias caused by selective attrition. It is generally thought that the problem of attrition is especially large in psychiatric epidemiological studies, where respondents may be less motivated or feel ashamed of their disorder and where avoidance behavior or loss of interest associated with psychiatric disorders may contribute to attrition. Several (nonpsychiatric) longitudinal studies have shown that depressive symptoms are predictive of attrition [1], and attrition rates are indeed substantial in some psychiatric epidemiological studies, ranging from 20% to 40% at 1-year follow-up [2-5].

The most often studied types of attrition are refusal and noncontact [6], but death and inability to participate are types that are of interest as well. Especially, inability to participate is important in psychiatric research because it most likely involves persons whose mental health problems have exacerbated (leading to hospitalization etc). To make the right decisions during the analytic phase—for instance, in model building for imputation—and for a correct

Conflicts of interest: WA Nolen has received grants from the Netherlands Organisation for Health Research and Development, European Union, Stanley Medical Research Institute, Astra Zeneca, Eli Lilly, GlaxoSmithKline, and Wyeth, received honoraria/speaker's fees from Astra Zeneca, Eli Lilly, Pfizer, Servier, and Wyeth, and is advisory board member for Astra Zeneca, Cyberonics, Pfizer, and Servier. All other authors declare that they have no conflicts of interest.

* Corresponding author. Department of Psychiatry, VU University Medical Center Amsterdam, 1081 HL Amsterdam, The Netherlands.
E-mail address: f.lamers@vumc.nl (F. Lamers).

0010-440X
doi:10.1016/j.comppsych.2011.01.011

interpretation of the results, it is important to have knowledge on the determinants of attrition. Because mechanisms behind attrition differ between types of attrition, it is important to make a distinction between types of attrition when evaluating its determinants [6,7].

Baseline sociodemographic and psychiatric diagnoses are the variables of interest in most psychiatric epidemiological studies that evaluate attrition. Some studies found neither sociodemographic nor psychiatric diagnoses to be associated with attrition [8], one study found only Symptom Checklist 90-R score as a determinant of attrition but no role for sociodemographic variables [9], whereas others identified sociodemographic variables as determinants for refusal and both sociodemographic and psychiatric diagnoses as determinants for noncontact or overall attrition [2-5]. Thus, discrepancies exist in which group of factors—sociodemographic or psychiatric diagnoses—are associated with attrition. In addition, it remains unclear how clinical psychiatric characteristics such as age of onset, family history, and duration are associated with attrition, although such information would create a better picture of the type of participant that is most likely to drop out.

This study aims to evaluate which baseline sociodemographic and psychiatric characteristics are associated with attrition at 2-year follow-up in a longitudinal naturalistic cohort study (n = 2981) on the course of depressive and anxiety disorders and to evaluate the relative importance of sociodemographic and psychiatric characteristics on attrition. Differences in determinants between types of attrition will be examined, and furthermore, we will evaluate whether clinical characteristics are associated with attrition.

2. Methods

2.1. Sample

The Netherlands Study of Depression and Anxiety (NESDA) is a longitudinal naturalistic cohort study, consisting of 2981 persons (18-65 years) including those with lifetime and/or current anxiety and/or depressive disorders (n = 2329; 78%) and healthy controls (n = 652; 22%) [10]. Participants were recruited from the community (n = 564; 19%), primary care (n = 1610; 54%), and specialized mental health care (n = 807; 27%) from September 2004 through February 2007 at 3 study sites (Amsterdam, Groningen, Leiden). In primary care, all persons consulting their general practitioner in the last 4 months irrespective of reason for consultation were screened for the presence of depression and anxiety symptoms (Kessler 10 with additional questions regarding symptoms of anxiety) and, when having a positive score, invited for a diagnostic interview, after which persons with a confirmed diagnosis were invited to participate. In specialized mental health care settings, all newly enrolled patients were invited to participate. All participants recruited from the community (n = 564) previously participated in community-based longitudinal cohort studies (NEMESIS [11] and ARIADNE [10,12]). From NEMESIS, we included participants with a 12-month prevalent depressive or anxiety disorder diagnosis at baseline or a diagnosis during any of the 2 follow-up NEMESIS assessments and who did not have a Composite International Diagnostic Interview (CIDI) diagnosis of any of the psychiatric diagnoses belonging to the NESDA exclusion criteria. From ARIADNE, we recruited participants among a group of persons who were fluent in Dutch, who did not have a CIDI diagnosis of excluding psychiatric diagnoses, and who had agreed to be contacted for additional research. Exclusion criteria used in NESDA were (1) a primary clinical diagnosis of psychotic disorder, obsessive compulsive disorder, bipolar disorder, or severe addiction disorder and (2) not being fluent in Dutch. Approval of the study protocol was granted by the ethical review boards of all participating centers, and all participants gave written informed consent.

2.2. Initial nonresponse in the recruitment phase

Within primary care, nonresponse to the first phase of recruitment (using a screening questionnaire) was 55%. Within specialized mental health care, where clinical staff of participating mental health care organizations submitted newly enrolled patients with a primary diagnosis of depression or anxiety to the study, 43% refused. Nonresponse in the NESDA recruitment phase was only associated with being male and being younger in the primary care setting and with being younger in the specialized mental health care setting, as is also more thoroughly described elsewhere (Penninx et al, 2008; Van der Veen et al, 2010). Of the 662 NEMESIS participants who were approached with an invitation to participate in NESDA, 54.2% refused participation, but those who refused did not differ in age, sex, or type of baseline disorder (anxiety, depression, or comorbid disorder) from those participating. Of the ARIADNE sample, 261 persons were included in NESDA. These persons were more often female and more often had a lifetime depressive or anxiety disorder compared with the 267 ARIADNE participants who were not included in NESDA.

2.3. Baseline measurement and follow-up

The baseline assessment and the 2-year follow-up assessment included a 4-hour interview at one of the 3 study sites, during which information was collected on psychopathology, demographic characteristics, and physical and psychosocial functioning. It further included a medical assessment, computer tasks, and 2 self-administered questionnaires. After the assessment, participants received a gift certificate of €15 and payment of travel costs.

For the 2-year follow-up, all participants were invited to come to one of the 3 study sites for an assessment. Participants first received an information letter announcing a telephone call 1 week later to set up an appointment.

Interviewers made at least 8 initial attempts to contact participants (at various times of day, at various days) and sent a letter requesting the participant to contact the interviewers if attempts were unsuccessful. The accuracy of contact information of participants recruited in primary care and specialized mental health care was checked with their health care provider. If no contact had been made within 1 week, the contact person provided by the participant at baseline was contacted to check the accuracy of the participant's contact information. After 5 further attempts to reach the participant, attempts were halted. Ten days before their appointments, participants received a reminder letter. If participants did not show up for their appointment, they were rescheduled for a new appointment using the aforementioned protocol. If a participant was unable or unwilling to come to the study site, interviewers offered to do a shortened assessment (without the computer tasks), to do the shortened assessment at the participants' home or by telephone. Reasons for nonresponse at 2-year follow-up, as stated by the participants, were recorded by the interviewers, using precoded nonresponse options.

2.4. Measurements

2.4.1. Attrition

The outcome measure was a dichotomous variable for attrition at 2-year follow-up (yes/no). In a second variable, attrition was categorized into 4 groups of persons, namely, those who (1) refused, (2) were unable to participate, (3) could not be contacted, or (4) had died.

2.4.2. Baseline sociodemographic characteristics

Sociodemographic variables studied included age, sex, years of education, North European ancestry (yes/no), sampling site (Amsterdam, Groningen, Leiden), employment status (yes/no), partner status (yes/no), and urbanization grade (low/high). Urbanization grade was based on address density in a 1-km area around the respondent's address. Low urbanization was defined as <1500 addresses per square kilometer, and high urbanization as ≥1500 addresses per square kilometer [13]. Because persons who have previously participated in longitudinal research are probably more motivated and more likely to continue their participation in NESDA, previous participation in research (yes/no) was considered as a determinant of attrition. Although not a sociodemographic variable, an indicator variable of overall health was added to this group of variables. A count was made from self-reported presence of chronic diseases (including lung disease, cardiovascular disease, diabetes, osteoarthritis, cancer, gastrointestinal disease, liver disease, epilepsy, and thyroid disease) for which they received medical treatment.

2.4.3. Baseline psychiatric characteristics

Psychiatric disorders considered were the 1-year diagnoses of depressive disorders (major depressive disorder [MDD] and dysthymia), anxiety disorders (social phobia, panic disorder with/without agoraphobia, agoraphobia, and generalized anxiety disorder [GAD]), and alcohol use disorders (alcohol dependence and alcohol abuse). The CIDI lifetime version 2.1 [14], a reliable and valid instrument for assessing psychopathology [15], was used to diagnose disorders according to *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition* criteria and was conducted by trained clinical research staff.

Type of disorders was expressed in a categorical variable, distinguishing those without disorders (n = 1198), those with depressive disorder only (n = 420), those with anxiety disorder only (n = 508), and those with comorbid depressive and anxiety disorder (n = 855). Age of onset was derived from the CIDI interview, and for persons with comorbid depressive and anxiety disorder, the earliest age of onset of the disorders was used. Persons reporting first-degree family members who had ever experienced depression or anxiety in the family tree inventory [16] were considered to have a positive family history. For severity of the disorder, we used the 30-item Inventory of Depressive Symptomatology (Self-Report) [17], which also includes several items regarding anxiety symptoms and correlated high with the Beck Anxiety Inventory (r = 0.78). Duration of depressive or anxiety symptoms was based on the life chart. This assessment used a calendar method to determine life events during the 4 years before baseline to refresh memory and then retrospectively assessed presence of depressive and anxiety symptoms in this period [18]. From this, the percentage of time with depressive or anxiety symptoms during the 4 years before baseline was computed. Current (1-year) comorbid alcohol use disorders were based on the CIDI.

2.5. Statistical analyses

All analyses were performed using SPSS 15.0 (SPSS, Chicago, IL). Descriptive statistics were used to describe the sociodemographic and psychiatric characteristics across attrition status. Logistic regression analyses were performed to examine sociodemographic and psychiatric determinants of attrition. Explained variance (Nagelkerke's R^2) was used to evaluate which set of variables (sociodemographic variables or psychiatric variables) were more important in determining attrition. Differences in determinants for different types of attrition (refusal, noncontact, not able) were evaluated using multinomial logistic regression. Subsequently, within a subsample of persons with a current (1-year) depressive or anxiety disorder at baseline (n = 1783), associations between clinical psychopathologic characteristics and attrition were studied using logistic regression analyses.

3. Results

Of the 2981 persons included in the study at baseline, a very large percentage (87.1%; n = 2596) participated in the 2-year follow-up. Of the persons not participating, 6 (0.2%)

had died, 250 (8.4%) refused to participate, 78 (2.6%) were unable to participate because of health reasons, and 51 (1.7%) persons could not be contacted (Table 1). Because only few persons had died during the follow-up period, and this may be a rather specific group of nonresponders, this category was omitted from further analyses. Median number of months between the baseline interview and the 2-year follow-up was 24 months (interquartile range [IQR], 24-25).

Persons who did not participate in the 2-year follow-up assessment had less years of education, were less often of North European descent, were more often recruited in Amsterdam and living in higher urbanized areas, had less often participated in earlier research, and were less often employed than respondents (Table 2). Those not participating further more often had MDD, dysthymia, social phobia, panic disorder with agoraphobia, and GAD than respondents.

To identify determinants of attrition, we performed analyses in which we first ran a model containing only sociodemographic variables (model 1) (Table 3). Then, we ran a model with only psychiatric variables (model 2), and in a third model, we entered both groups of variables (model 3). Younger age, less years of education, not being of North European descent, having been recruited in Amsterdam, and not having previously participated in research were determinants of attrition. Of the psychiatric diagnoses, only MDD and panic disorder with agoraphobia were determinants of attrition, although panic disorder with agoraphobia was no longer a significant determinant in model 3. Sociodemographic variables seemed to be somewhat more important in determining attrition than psychiatric variables, given the slightly higher explained variance (Nagelkerke's R^2) value for model 1 compared with model 2.

The analysis evaluating the determinants of different types of attrition (Table 4) revealed only a few differences between attrition types. Persons unable to participate were significantly older than the respondents to the 2-year follow-up assessment. In contrast, refusers and those not contacted were significantly younger than respondents, with noncontacts being younger than refusers. Effects of sampling site were present in refusers and noncontacts but not in those unable to participate. Furthermore, no previous research participation was a determinant for refusal, and a similar trend was observed for not being able to participate, but the effect in noncontacts pointed in the opposite direction and was significantly different from the effect in refusers. Major depressive disorder was a significant determinant in all types of attrition. No differences were found in the effects of psychopathology between types of attrition.

Therefore, no distinction between types of attrition was made in the analyses of clinical psychopathologic characteristics. Fig. 1 presents the effects of comorbidity on attrition, adjusted for all sociodemographic variables, and alcohol use disorders. Although the odds ratio of attrition for persons with a depressive disorder only was 1.45 (95% confidence interval [CI], 1.00-2.11; $P = .05$) compared with those without disorders, the odds ratio for those with comorbid depression and anxiety disorder was 2.41 (95% CI, 1.80-3.24; $P < .001$).

Table 1
Attrition at 2-year follow-up (n = 2981)

	n (%)
Respondents at 2-y follow-up	2596 (87.1)
Nonrespondents at 2-y follow-up	385 (12.9)
Reasons of attrition	
Deceased	6 (0.2)
Refusal	
No interest/no time	208 (7.0)
Bad experience with previous interview	32 (1.1)
No reason	10 (0.3)
Unable	
Due to physical reasons	21 (0.7)
Due to mental reasons	57 (1.9)
Noncontact	
No contact	40 (1.3)
Moved abroad	11 (0.4)

Table 2
Baseline characteristics by attrition status at the 2-year follow-up assessment

	Respondents (n = 2596)	Nonrespondents (n = 379)	P*
Sociodemographic variables			
Age (y), mean (SD)	42.0 (13.1)	40.9 (12.9)	.12
Female (%)	66.1	68.9	.29
Education, mean y (SD)	12.3 (3.2)	11.3 (3.1)	<.001
North European descent (%)	95.5	89.7	<.001
Sampling site (%)			
Amsterdam	39.6	50.9	
Leiden	30.2	29.3	<.001
Groningen	30.1	19.8	
Urbanization grade (%)			
High urbanization	70.0	74.9	<.05
Previous participation in psychiatric study			
Yes	20.1	10.6	<.001
Employment status (%)			
Employed	64.1	58.6	.04
Partner status (%)			
No partner	30.7	30.9	.95
No. of chronic somatic diseases, median (IQR)	0.0 (1)	0 (1)	.23
Psychopathology			
Depressive disorders (%)			
Major depressive disorder	38.8	58.6	<.001
Dysthymia	9.9	17.7	<.001
Anxiety disorders (%)			
Social phobia	22.2	31.1	<.001
Panic disorder with agoraphobia	13.6	21.6	<.001
Panic disorder without agoraphobia	8.7	12.4	.02
Agoraphobia	6.2	8.2	.15
GAD	15.3	25.1	<.001
Alcohol use disorders (%)			
Alcohol dependence	5.2	7.4	.08
Alcohol abuse	4.2	4.7	.62

* Based on χ^2 tests for categorical variables, t test for continuous variables, and Mann-Whitney U tests for non-normal distributed variables.

Table 3
Multivariable associations of baseline sociodemographic and psychopathology variables with the odds ratio (OR) of attrition after 2 years

	Attrition (n = 379)					
	Model 1		Model 2		Model 3	
	Adjusted OR[a]	95% CI	Adjusted OR[b]	95% CI	Adjusted OR[c]	95% CI
Sociodemographic variables						
Age (per y increase)	0.98	0.97-0.99‡			0.99	0.98-0.99*
Female vs male	1.06	0.83-1.34			1.07	0.84-1.37
Education (per y increase)	0.89	0.86-0.93‡			0.91	0.88-0.94‡
Non–North European descent vs North European descent	1.89	1.27-2.81†			1.77	1.18-2.66†
Sampling site						
Amsterdam	Ref				Ref	
Leiden	0.66	0.50-0.87†			0.65	0.49-0.85†
Groningen	0.51	0.38-0.70‡			0.50	0.37-0.69‡
High vs low urbanization	1.03	0.78-1.36			1.14	0.86-1.50
Previous participation in research	0.49	0.34-0.70‡			0.66	0.45-0.96*
Not employed vs employed	1.20	0.95-1.51			1.16	0.92-1.47
No partner vs partner	0.92	0.72-1.17			0.85	0.66-1.08
No. of chronic somatic diseases	1.03	0.90-1.17			0.99	0.87-1.13
Psychopathology						
Depressive disorders						
MDD			1.80	1.40-2.30‡	1.62	1.26-2.09‡
Dysthymia			1.26	0.92-1.74	1.29	0.93-1.79
Anxiety disorders						
Social phobia			1.10	0.85-1.43	1.06	0.81-1.38
Panic disorder with agoraphobia			1.45	1.07-1.97*	1.27	0.93-1.73
Panic disorder without agoraphobia			1.36	0.96-1.95	1.28	0.89-1.84
Agoraphobia			1.34	0.88-2.04	1.19	0.78-1.83
GAD			1.24	0.93-1.64	1.14	0.86-1.52
Alcohol use disorders						
Alcohol dependence			1.13	0.73-1.75	1.27	0.81-1.98
Alcohol abuse			1.31	0.78-2.19	1.29	0.76-2.22
Nagelkerke's R^2	0.067		0.045		0.091	

[a] Based on multivariable logistic regression with all sociodemographic variables entered in model, with respondents (n = 2596) as reference.
[b] Based on multivariable logistic regression with all psychiatric variables entered in model, with respondents (n = 2596) as reference.
[c] Based on multivariable logistic regression with all sociodemographic and psychiatric variables entered in model, with respondents (n = 2596) as reference.
* $P < .05$.
† $P < .01$.
‡ $P < .001$.

The influence of clinical psychopathologic characteristics on attrition was subsequently evaluated within a group of persons with depressive and/or anxiety disorder (n = 1783). Only comorbidity compared with depressive disorder only and higher severity were associated with attrition (OR comorbid depression and anxiety, 1.83; 95% CI, 1.25-2.69; $P = .002$ OR severity per Inventory of Depressive Symptomatology point increase, 1.02; 95% CI, 1.01-1.03; $P = .001$) (Table 5).

4. Discussion

This study found that overall attrition at the 2-year follow-up of NESDA was very limited (12.9%). Determinants of attrition were younger age, less years of education, not being of North European descent, having been recruited in Amsterdam, no previous participation in research, and having MDD. Thus, both sociodemographic as well as psychiatric determinants of attrition were confirmed, with a somewhat larger influence of sociodemographic variables. Additional analyses further showed that the effect of determinants on refusal, noncontact, and not able to participate were largely comparable. Differential effects were only found for age, sampling site, and previous participation in research, whereas the effects of psychopathology were similar between types of attrition. Although psychiatric diagnoses other than depressive disorder were not associated with attrition, persons with a comorbid depressive and anxiety disorder were 2.4 times more likely to drop out compared with persons without psychopathology. Comorbid depression and anxiety compared with depression alone and a higher symptom severity were associated with an increased odds of attrition.

In our study, the attrition rate at the 2-year follow-up was relatively low (12.9%) as compared with other psychiatric epidemiological studies. For instance, in the Zurich cohort study, the attrition rate at 2-year follow-up was 23% [9],

Table 4
Multivariable associations of baseline sociodemographic and psychopathology variables with the odds ratio (OR) of different types of attrition after 2 years

	Refusal (n = 250)		Noncontact (n = 51)		Not able (n = 78)		*P*		
	Adjusted OR[a]	95% CI	Adjusted OR[a]	95% CI	Adjusted OR[a]	95% CI	R vs NC	R vs NA	NC vs NA
Sociodemographic variables									
Age (per y increase)	0.98	0.97-1.00[†]	0.96	0.93-0.98[‡]	1.02	1.00-1.05*	.05	.001	<.001
Female vs male	0.96	0.72-1.27	0.92	0.49-1.71	1.65	0.95-2.85	.91	.08	.16
Education (per y increase)	0.90	0.86-0.94[‡]	0.95	0.87-1.05	0.90	0.83-0.97[†]	.26	.93	.31
Non–North European descent vs North European descent	1.53	0.93-2.51	2.97	1.36-6.51[†]	1.87	0.81-4.34	.14	.67	.42
Sampling site									
Amsterdam	Ref		Ref		Ref				
Leiden	0.75	0.55-1.04	0.17	0.07-0.46[‡]	0.69	0.39-1.25	.004	.80	.02
Groningen	0.45	0.30-0.66[‡]	0.28	0.12-0.66[†]	0.97	0.53-1.76	.33	.03	.02
High vs low urbanization	1.03	0.74-1.42	1.74	0.74-4.10	1.33	0.74-2.38	.25	.43	.61
Previous participation in research	0.55	0.35-0.88*	1.74	0.74-4.07	0.62	0.25-1.53	.02	.82	.10
Not employed vs employed	1.11	0.84-1.48	1.00	0.55-1.85	1.43	0.89-2.32	.75	.36	.36
No partner vs partner	0.86	0.64-1.16	1.22	0.68-2.20	0.61	0.36-1.05	.28	.27	.08
No. of chronic somatic diseases	1.00	0.85-1.17	1.24	0.91-1.70	0.85	0.65-1.12	.22	.30	.07
Psychopathology									
Depressive disorders									
MDD	1.40	1.04-1.89*	2.44	1.23-4.86*	2.22	1.26-3.89[†]	.14	.15	.83
Dysthymia	1.02	0.67-1.56	1.80	0.85-3.81	1.79	1.01-3.18*	.18	.11	.99
Anxiety disorders									
Social phobia	1.05	0.77-1.45	0.80	0.41-1.59	1.28	0.75-2.17	.47	.52	.28
Panic disorder with agoraphobia	1.19	0.81-1.74	0.98	0.43-2.23	1.58	0.89-2.82	.67	.40	.34
Panic disorder without agoraphobia	1.41	0.93-2.16	1.57	0.67-3.66	0.74	0.30-1.82	.83	.19	.23
Agoraphobia	1.42	0.88-2.32	1.02	0.33-3.12	0.66	0.23-1.90	.58	.18	.57
GAD	0.89	0.62-1.28	1.78	0.92-3.47	1.61	0.94-2.77	.07	.06	.82
Alcohol use disorders									
Alcohol dependence	1.17	0.67-2.05	1.54	0.57-4.14	1.31	0.56-3.03	.63	.83	.80
Alcohol abuse	1.31	0.71-2.42	0.80	0.18-3.52	1.41	0.41-4.78	.54	.91	.56

NA indicates not able; NC, noncontact; R, refusal.

[a] Based on multivariable multinomial logistic regression with all sociodemographic and psychiatric variables entered in model, with respondents (n = 2596) as reference.

* $P < .05$.

[†] $P < .01$.

[‡] $P < .001$.

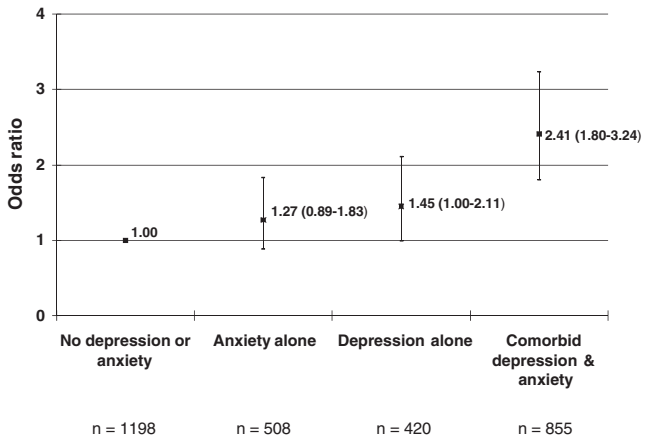

Fig. 1. Odds ratios* (95% CI) for attrition in psychopathology groups vs persons without depression and anxiety. *Adjusted for age, sex, education, North European descent, sampling site, previous participation in research, urbanization grade, employment status, partner status, number of chronic illnesses, alcohol dependence, and alcohol abuse.

whereas other studies yielded rates around 20% at 1-year follow-up [2,3]. Nevertheless, other psychiatric studies have reported even lower attrition rates over longer follow-up periods, for instance, 8.4% over 12-year follow-up in the CDS study [19] and around 17% in the Lundby cohort study over 15 years [19-21]. The Netherlands Study of Depression and Anxiety participants recruited from existing longitudinal cohorts proved to be a group of committed and motivated persons. When excluding these persons from the calculation, the attrition rate was still low (14.2%). Furthermore, extensive efforts of the interviewers to locate and contact participants and of offering shortened interviews when considered necessary, resulted in a very small noncontact group (1.7%).

Our results regarding the sociodemographic determinants of attrition are, to a high degree, comparable with the results from the NEMESIS and the ECA study [2,3]. As in NESDA, lower education was a predictor of refusal in both studies, although in NEMESIS it was also associated with

Table 5
Associations of baseline clinical characteristics and attrition after 2 years in a subset of anxious and depressed persons (n = 1783)

	Attrition (n = 264)	
	Adjusted OR[a]	95% CI
Diagnostic group		
Depression only	Ref	
Anxiety only	1.19	0.76-1.85
Comorbid depression and anxiety	1.83	1.25-2.69[†]
Early age of onset (<21 y)	0.83	0.61-1.11
First-degree family history	0.83	0.56-1.23
Severity (per IDS point increase)	1.02	1.01-1.03[†]
Duration of symptoms	1.00	0.99-1.00
Alcohol dependence	1.33	0.81-2.18
Alcohol abuse	1.48	0.77-2.85

IDS indicates Inventory of Depressive Symptomatology.

[a] All clinical characteristics simultaneously in model, corrected for age, sex, education, North European descent, sampling site, previous participation in research, urbanization grade, employment status, partner status, number of chronic illnesses, alcohol dependence, and alcohol abuse; responders (n = 2596) are reference.

[†] $P < .01$.

noncontact. In both the NEMESIS and the ECA study, younger age was a predictor only of noncontact; in NESDA, it was a determinant for both refusal and noncontact. Our findings regarding North European descent and the number of chronic diseases were also in line with findings for ethnicity in the ECA and NEMESIS studies. Persons with a different ethnic background may be more unwilling because of cultural differences in discussing psychiatric topics, or they may have experienced more difficulties with participating in the baseline assessment; both could result in increased dropout after baseline. In contrast to the NEMESIS and ECA studies, not having a partner was not associated with noncontact in the NESDA study. In addition, no effect of sex was found in our study, whereas male sex was a determinant of noncontact in the ECA study. The Netherlands Study of Depression and Anxiety participants recruited in Amsterdam were more likely to drop out than participants recruited in Leiden and Groningen. This effect could not be explained by differences in urbanization grade, but it is possible that regional differences in attitude and mentality, residential mobility, and differences between research assistants play a role. The fact that not having previously participated in research was a determinant of refusal once again indicates that keeping participants committed and motivated is very important to retain them in the study.

We found that MDD predicted all types of attrition. This is in contrast with the NEMESIS and ECA studies, that both found that psychopathology was mainly associated with noncontact and mortality/morbidity but not with refusal. However, both studies only adjusted for sociodemographic variables and not for other psychiatric disorders in their analyses.

We further studied the effect of comorbidity. The comorbid group had a significant higher odds ratio for attrition, whereas the depression alone group showed a trend toward a higher odds for attrition, which is in line with previous finding [2,3]. To our knowledge, no other study on attrition in psychiatric epidemiological research has extensively evaluated the influence of a large set of clinical characteristics on attrition before. Of all clinical characteristics under study, only comorbid depression and anxiety and a higher severity—both indicators of severity of the disorder—were significantly and independently associated with attrition. This shows that besides the presence of a depressive disorder, the severity plays an important role in determining attrition, and these latter findings support the theory that persisting disorders hinder participation opposed to having residual symptoms. The Zurich cohort study similarly found that high symptom scores were associated with attrition [9].

Evaluating determinants of attrition in a study is important because if attrition is selective, it may limit the generalizability of the study outcomes. Knowledge of the determinants of attrition is further important if researchers use imputation techniques to replace missing data because accounting for attrition mechanisms is a crucial step to obtain "valid" imputed values in imputation techniques such as multiple imputation [22]. With the incorporation of multiple imputation modules in standard statistical software packages such as SPSS, this technique has become available for a larger group of researchers than before, and it is increasingly being used in epidemiological studies [23,24]. For future psychiatric cohort studies, it may be advisable to oversample those that are at higher risk of dropout, namely, younger persons, persons with lower educational level, persons with comorbid psychiatric disorders, and persons with a higher severity.

A limitation of this study is that due to the number of determinants under study, there is a possibility of a chance finding due to multiple testing. It should also be noted that attrition from an interview may be a different phenomenon than attrition from a survey study, and our findings may, therefore, not be generalizable to studies using self-administered questionnaires.

5. Conclusion

To conclude, this study confirmed both sociodemographic as well as psychiatric determinants of attrition, with a slightly higher influence of sociodemographic variables. Only MDD was associated with attrition, and especially those with a comorbid depression/anxiety and those with a higher depression severity were more prone to drop out from the study. Although the general thought is that psychiatric studies are more prone to high attrition rates, this study showed that, even with 4-hour-long assessments that require a substantial time investment of the participant, it is possible

to keep attrition rates relatively low in psychiatric longitudinal studies.

Acknowledgment

The infrastructure for the NESDA study (www.nesda.nl) is funded through the Geestkracht program of the Netherlands Organisation for Health Research and Development (ZonMw, grant number 10-000-1002) and is supported by participating universities and mental health care organizations (VU University Medical Center, GGZ inGeest, Arkin, Leiden University Medical Center, GGZ Rivierduinen, University Medical Center Groningen, Lentis, GGZ Friesland, GGZ Drenthe, IQ Healthcare, Netherlands Institute for Health Services Research [NIVEL] and Netherlands Institute of Mental Health and Addiction [Trimbos]).

References

[1] Farmer ME, Locke BZ, Liu IY, Moscicki EK. Depressive symptoms and attrition: the NHANES I epidemiologic follow-up study. Int J Methods Psychiatr Res 1994;4:19-27.
[2] de Graaf R, Bijl RV, Smit F, Ravelli A, Vollebergh WA. Psychiatric and sociodemographic predictors of attrition in a longitudinal study: The Netherlands Mental Health Survey and Incidence Study (NEMESIS). Am J Epidemiol 2000;152(11):1039-47.
[3] Eaton WW, Anthony JC, Tepper S, Dryman A. Psychopathology and attrition in the epidemiologic catchment area surveys. Am J Epidemiol 1992;135(9):1051-9.
[4] Fischer EH, Dornelas EA, Goethe JW. Characteristics of people lost to attrition in psychiatric follow-up studies. J Nerv Ment Dis 2001;189 (1):49-55.
[5] Bellon JA, Luna JD, Moreno B, Monton-Franco C, Gildegomez-Barragan MJ, Sanchez-Celaya M et al. Psychosocial and sociodemographic predictors of attrition in a longitudinal study of major depression in primary care: the predictD-Spain study. doi:10.1136/jech.2008.085290.
[6] Groves RM, Couper MP. Nonresponse in household interview surveys. New York: Wiley; 1998.
[7] Antonovics K, Haveman R, Holden K, Wolfe B. Attrition in the new beneficiary survey and followup, and its correlates. Soc Secur Bull 2000;63(1):40-51.
[8] Bruce SE, Yonkers KA, Otto MW, Eisen JL, Weisberg RB. Pagano Met al. Influence of psychiatric comorbidity on recovery and recurrence in generalized anxiety disorder, social phobia, and panic disorder: a 12-year prospective study. Am J Psychiatry 2005;162 (6):1179-87.
[9] Eich D, Ajdacic-Gross V, Condrau M, Huber H, Gamma A, Angst J, et al. The Zurich study: participation patterns and Symptom Checklist 90-R scores in six interviews, 1979-99. Acta Psychiatr Scand Suppl 2003(418):11-4.
[10] Penninx BW, Beekman AT, Smit JH, Zitman FG, Nolen WA, Spinhoven P, et al. The Netherlands Study of Depression and Anxiety (NESDA): rationale, objectives and methods. Int J Methods Psychiatr Res 2008;17(3):121-40.
[11] Bijl RV, van ZG, Ravelli A, de RC, Langendoen Y. The Netherlands Mental Health Survey and Incidence Study (NEMESIS): objectives and design. Soc Psychiat Epidemiol 1998;33(12):581-6.
[12] Landman-Peeters KM, Hartman CA, van der PG, den Boer JA, Minderaa RB, Ormel J. Gender differences in the relation between social support, problems in parent-offspring communication, and depression and anxiety. Soc Sci Med 2005;60(11):2549-59.
[13] Statistics Netherlands. Definition degree of urbanisation. http://www.cbs.nl/nl-NL/menu/methoden/begrippen/default.htm?ConceptID=658. date accessed: 2010/07/31/.
[14] World Health Organisation. Composite International Diagnostic Interview, Core version 2.1: Interviewer's Manual. Sidney, Australia: World Health Organisation; 1997.
[15] Wittchen HU. Reliability and validity studies of the WHO–Composite International Diagnostic Interview (CIDI): a critical review. J Psychiatr Res 1994;28(1):57-84.
[16] Fyer AJ, Weissman MM. Genetic linkage study of panic: clinical methodology and description of pedigrees. Am J Med Genet 1999;88 (2):173-81.
[17] Rush AJ, Gullion CM, Basco MR, Jarrett RB, Trivedi MH. The Inventory of Depressive Symptomatology (IDS): psychometric properties. Psychol Med 1996;26(3):477-86.
[18] Lyketsos CG, Nestadt G, Cwi J, Heithoff K, Eaton WW. The life-chart method to describe the course of psychopathology. Int J Methods Psychiatr Res 1994;4:143-55.
[19] Judd LL, Akiskal HS, Maser JD, Zeller PJ, Endicott J, Coryell W, et al. A prospective 12-year study of subsyndromal and syndromal depressive symptoms in unipolar major depressive disorders. Arch Gen Psychiatry 1998;55(8):694-700.
[20] Mattisson C, Bogren M, Horstmann V, Tambs K, Munk-Jorgensen P, Nettelbladt P. Risk factors for depressive disorders in the Lundby cohort—a 50 year prospective clinical follow-up. J Affect Disord 2009;113(3):203-15.
[21] Nettelbladt P, Bogren M, Mattisson C, Ojesjo L, Hagnell O. Hofvendahl Eet al. Does it make sense to do repeated surveys?—the Lundby Study, 1947-1997. Acta Psychiatr Scand 2005;111(6):444-52.
[22] van Buuren S, Boshuizen HC, Knook DL. Multiple imputation of missing blood pressure covariates in survival analysis. Stat Med 1999;18(6):681-94.
[23] Harel O, Zhou XH. Multiple imputation: review of theory, implementation and software. Stat Med 2007;26(16):3057-77.
[24] Sterne JA, White IR, Carlin JB, Spratt M, Royston P, Kenward MG, et al. Multiple imputation for missing data in epidemiological and clinical research: potential and pitfalls. BMJ 2009;338:b2393.